An English Dialogue Companion System for Supporting Conversation Practice

Yi-Ting Huang[a], Yi-Lung Lin[a], Jie-Chi Yang[a], and Yu-Chieh Wu[b]
[a]*Graduate Institute of Network Learning Technology, National Central University, Taiwan*
[b]*Department of Computer Science and Information Engineering, National Central University, Taiwan*
[a]{coral, nigel, yang}@cl.ncu.edu.tw, [b]bcbb@db.csie.ncu.edu.tw

Abstract: In this paper, we proposed an English dialogue companion system, called EDC, using predicate argument structure by Support Vector Machine (SVM) classifier for semantic analyzer in order to support elementary students for learning English one on one. Three phases of learning activities were designed to enhance the English learning environment, which are the choosing learning companion phase, the conversation phase, and the teaching phase. We also conducted a between-subject design experiment to evaluate the effectiveness of the EDC system in terms of English achievement and using experience. Results of this study showed that there is no significant difference between the experimental group and the control group on English achievement. However, more than half subjects in the lower score group got higher score in post-test than in pre-test. Thus, we assumed that the system could be useful for students in the lower English achievement degree.

Keywords: learning companion, dialogue system, English learning

Introduction

For the beginners of the second language learners, it is difficult to speak non-native language. Thus, dialogue system that simulates the human interaction can provide the learners with the opportunity to oral practice, so that releases the learners' psychological barrier. ELIZA is regarded as the first dialogue system and plays an important role in the history of dialogue system [1]. The development of Natural Language Processing, dialogue system can be asked to work in specific domain, such as Lingubot in commerce [2], Intelligent Medical Query System in medicine [3], and CSIEC in education [4]. However, Jia [5] pointed out the dialogue between human and the dialogue system does not often persist. It indicatsthat it is not appropriate if we apply the pure dialogue system to learning environments directly.

The 1980s saw a wealth of research into the application of artificial intelligence. Research on the artificial intelligence in education, Intelligent Tutoring Systems (ITS) is one of the important topics, aims at developing a simulated tutor who has an expert-like expertise to teach a student respectively. Chan extended the role of ITS to propose the Learning Companion Systems (LCS) [6], that does not only play the computer-simulated tutor role, but is a computer-simulated student. Compared with ITS, LCS provided the learning function further for learners: the difference of learning strategy, the opportunity of reflection, team work and so on [6][7]. There are many empirical evidences to support the positive learning impact of learning companion [7]. Therefore, we hope to enhance the dialogue system in learning environments by the benefit of learning companion.

In light of these concerns, we would like to combine the function of the learning companion with the dialogue system, and propose the English Dialogue Companion (also called EDC) system in order to support elementary students to learn second language. We would like to achieve the two purposes in this paper: (a) to implement a dialogic learning companion system to assist elementary students to practice conversation and (b) to conduct an evaluation to figure out the impact on English achievement and using experience.

1. Design of English Dialogue Companion

The main idea of the EDC system is a learning companion who can speak English to a second language learner. The design of the EDC system must be suitable for specific learners to practice English conversation. We design the expertise of the learning companion is equal to the learner, such as an elementary student. In the interaction of the English Dialogue Companion, we design three learning activities to enhance learner's second language learning, which are the choosing learning companion phase, the conversation phase and the teaching phase. Firstly, the learner has to choose two animated pictures to represent his learning companion and himself in the choosing learning companion phase. Then, the learner has a conversation with his learning companion in the conversation phase. Finally, the learner can add new vocabulary to teach his learning companion in the teaching phase. In order to make the learner really understand the learning material, his learning companion will make some mistakes to disturb him. We have described the design of the system more detailed in [8].

2. System Overview

Figure 1 shows the system architecture of the EDC system, it is composed of input module, dialogue manager, knowledge base, and output module. In the input module, system receives three types of input format, such as sentence, utterance, and graphical action. Utterance will turn into sentences by speech recognizer, which is performed by the CMU Sphinx 4 recognizer [9]. Then, the input will be processing by the dialogue manager.

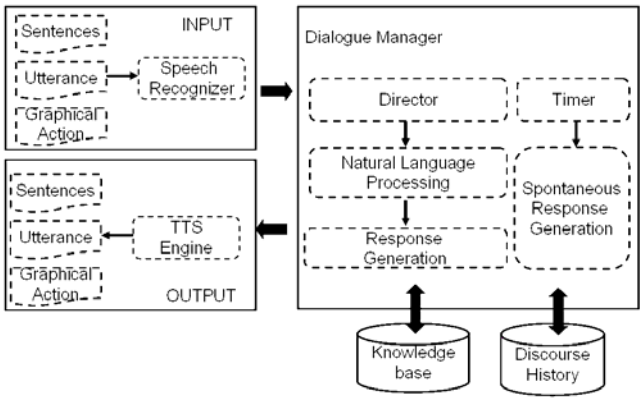

Figure 1. The system architecture of the EDC system.

Dialogue manager controls the communication between the components, including director, natural language processing, response generation, timer and spontaneous response generation. As soon as the dialogue manager gets the message from input module, it will identify the status of the director in order to confirm who gets the dialogue control, and then pass the message to other components. There are four statuses in the EDC system, such as speaking (the learning companion responses while the learner speaks), response (the learning companion speaks while the learner responses), teaching (the learner teaches the

learning companion), and calling (the learning companion actively talks to the leaner while he idles).

When the status of the director is speaking, response, or teaching, the message will be passed to natural language processing. The natural language processing adopts predicate argument structure to semantic analyze the message [10]. And we apply the polynomial kernel SVM [11] which had trained by learning materials to classify the semantic role label. While the message is coming, the natural language processing will process semantic role labels generated by the classifier, and then pass them to the response generation.

As soon as the response generation gets the semantic role labeling resulted from the dialogue manager, the response generation will retrieve the appropriate response from the knowledge base. When the status of the director is speaking or response, the response generation will process data transform to search from knowledge base. The knowledge base is retrieved the appropriate response to the learner. When the status of the director is teaching, the response does not pass the learner directly but take the result apart randomly in order to make mistakes on purpose.

As soon as the learner idles over three minutes, the timer will notify the director of triggering the spontaneous response generation. Then the director will give spontaneous response generation the last status in order to assist the learner in response. The spontaneous response generation will process the response generation to give the learner the appropriate response and encourage him to practice while the dialogue control is on the learning companion. The learning companion will take the dialogue control back and talk actively while the dialogue control is on the learner. Otherwise, the learning companion's expression will change into bad mood in order to get the learner's attention back.

In output module, the system can present three types of output format, such as sentence, utterance, and graphical action. The response which is retrieved from knowledge base will be transformed into utterance by TTS engine adopted by FreeTTS [12]. Learning companion also showed different graphical actions to present his expression.

3. Evaluation

3.1 Methods

The experiment investigated the impact of the EDC system on learners' English achievement and using experience. The experimental design is between-subject design. The independent variable is English learning environment with the EDC system or without the EDC system. The dependent variables are English achievement and using experience. The English achievement adopted oral tests designed according to learning material. The using experience adopted ARCS motivation scale [13] and Agent Persona Instrument scale [14] in order to figure out the system design. 66 elementary students (two classes) in Chong-Ping elementary school in Taiwan participated in the evaluation. One class was assigned to the control group which was consisted of 33 subjects (16 male and 17 female) and the other one was assigned to the experimental group which was consisted of 33 subjects (17 male and 16 female). "New Smart! Book 6" which is the subjects' textbook is employed as learning materials. And two classes were taught the same English teacher. Before the experiment, we demoed the EDC system in order to confirm that the subjects were familiar with the system. And the subjects all were asked to take an oral prior test and fill out the background questionnaire in order to figure out the subjects' English speaking ability and English learning habits. In the procedure of the experiment, the control group learned English as usual, for instance, taking an English course or listening to English radio etc. Besides the regular English learning environments, the experimental group was asked to use the EDC system to practice English conversation twice a week. The experiment was hold in five

Table 1. The result of ARCS motivation and learning companion.

ARCS Motivation			Social judgments		
	Mean	S.D.		Mean	S.D.
Attention	4.03	0.40	Facilitating Learning	4.36	0.75
Relevance	4.17	0.30	Credible	4.43	0.71
Confidence	3.89	0.32	Human-Like	4.30	0.70
Satisfaction	4.26	0.22	Engaging	4.45	0.59

weeks, the subjects were asked to practice English conversation with the EDC system in twenty minutes. After the experiment, all subjects were asked to take an oral post-test and the subjects in the experimental group were asked to fill out questionnaires from 1 (strongly disagree) to 5 (strongly agree), in order to figure out their using experience. Moreover, 15 subjects who were draw randomly from the experimental group were asked to an interview.

3.2 Result and Discussion

English achievement

In English achievement, analysis of covariance (ANCOVA) was conducted, with prior oral test as covariates. The result shows that there is no significant difference between control group and experimental group ($F(1,63)=0.97, p>.05$). However, the adjusted statistics showed that the mean in the experimental group ($M=69.36$) was higher than the control group ($M=66.49$). We found that a strong relationship between grades and time on ordinarily English practice in the experimental group ($r=.39, p<.05$) and the control group ($r=.50, p<.01$). Therefore, we assumed that some students might keep the same English speaking ability whether they learn English with the system or not. Besides, we found that more than half subjects in the lower score group got higher score in post-test than in pre-test. Thus, we assumed that the system could be useful for the lower English achievement students.

ARCS Motivation

In order to figure out the system design whether motivate the learners to use, we adopted the ARCS model to examine. According to the left of the table 1 shows that the overall performance in ARCS motivation scale has been positive. In attention, 88% subjects expressed that the performance of the learning companion could keep their attention on the task. In relevance, 91% subjects agreed that communicating successfully in English is very important for them, so they were willing to practice conversation. Furthermore, one subject expressed that the dialogue with the learning companion had connected to his life experience, which attracted their notice and reinforce their impressions. In confidence, some subjects agreed the positive feedback from the learning companion had retained their confidence to learn more. However, some learners' inability could not maintain their confidence because frustrations might decrease their using motivation. In satisfaction, 94% subjects were glad to use the system to practice conversation. They were satisfied when they completed the task.

Learning Companion

In order to figure out the design of the learning companion whether fit for specific learners, we adopted the Agent Persona Instrument scale to evaluate the cognitive characteristics of the learning companion by learners' social judgment, consisted of facilitating learning, credible, human-like, and engaging. The right of the table 1 shows that the overall

performance of learning companion has been very positive. In facilitating learning, over than 80% subjects agreed that the learning companion helped them focused on the learning materials. In credible, most subjects believed the learning companion was useful and helpful. In human-like, most subjects considered that the emotional expression of the learning companion was vivid and funny. Therefore, the subjects were enjoyable when learning with the learning companion in engaging. To conclude, the learning companion plays an important role in companying subjects to practice English conversation.

4. Conclusion and Future works

We proposed an English dialogue companion system, using predicate argument structure by Support Vector Machine (SVM) classifier for semantic analyzer in order to support elementary students for learning English one on one. A between-subject design experiment was conducted to evaluate the effectiveness of the EDC system in terms of English achievement. Although a significant differential English achievement between the experimental group and the control group was not observed, it seems to be useful for the subjects in the lower score group. In the questionnaires of using experience, most subjects agreed that the system is useful and helpful for English learning. Future works will enhance the performance of the speech recognition and the response generation module.

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